

# Day-Night, Seasons & Eclipse

कैसे होता है दिन?  
क्यों होती है रात?  
कैसे बदलता है मौसम,  
महीनों के साथ?

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I.I.T.Kanpur

*The Science Behind*

# Day and Night

## Seasons

### Solar and Lunar Eclipse

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**Model, Computer Animation and Games are also available.**

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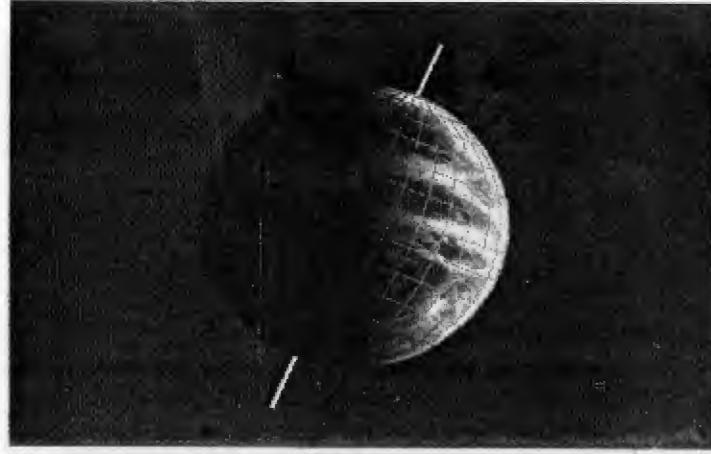
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## The Science of Day and Night



Earth is illuminated by the Sun. At any time only half of the Earth is illuminated. Here we have day. The other half with no light is having night.



The Earth rotates about its axis, and takes 24 hours to complete one revolution. That's why the Sun rises daily at 6 AM (approx.).

Actually the Sun is at its own place, and the Earth revolves around it.  
This is the reason for day and night.

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The Earth is divided into two parts. The middle line is called the Equator. Upper part is called northern hemisphere and lower part is called southern hemisphere.  $23\frac{1}{2}^{\circ}$  northern line is called the *Tropic of Cancer* and  $23\frac{1}{2}^{\circ}$  southern line is called the *Tropic of Capricorn*

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**Question 1** Where on earth the Sun's rays fall directly on one's head?

- a. line. 1
- b. line 2
- c. line 3

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**Question 2** In the previous figure, which line is the Equator?

- a. line. 1
- b. line 2
- c. line 3

**Question 3** In the previous figure, which line is the Tropic of Cancer?

- a. line. 1
- b. line 2
- c. line 3

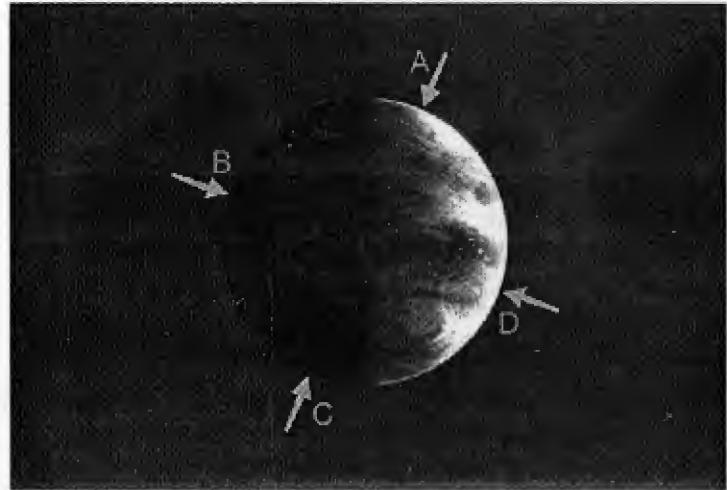
**Question 4** In the previous figure, which line is the Tropic of Capricorn?

- a. line. 1
- b. line 2
- c. line 3

**Question 5** In the previous figure, people living on the line 3 will have days of

- a. 12 Hours
- b. More than 12 hours
- c. Less than 12 hours

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**Question 6** Where is North Pole?

- a. A
- b. B
- c. C
- d. D

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**Question 7** In the previous figure, where is South Pole?

- a. A
- b. B
- c. C
- d. D

**Question 8** In the previous figure, where the days will be of 24 hours?

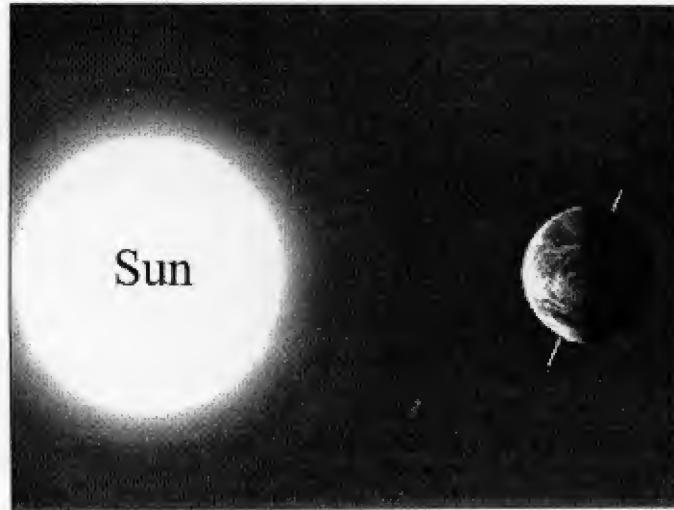
- a. A
- b. B
- c. C
- d. D

**Question 9** In the previous figure, where the nights will be of 24 hours?

- a. A
- b. B
- c. C
- d. D

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## Why does the weather change?



We see that the southern hemisphere receives more sun light than the northern hemisphere. That is why the southern hemisphere is hotter than northern hemisphere.

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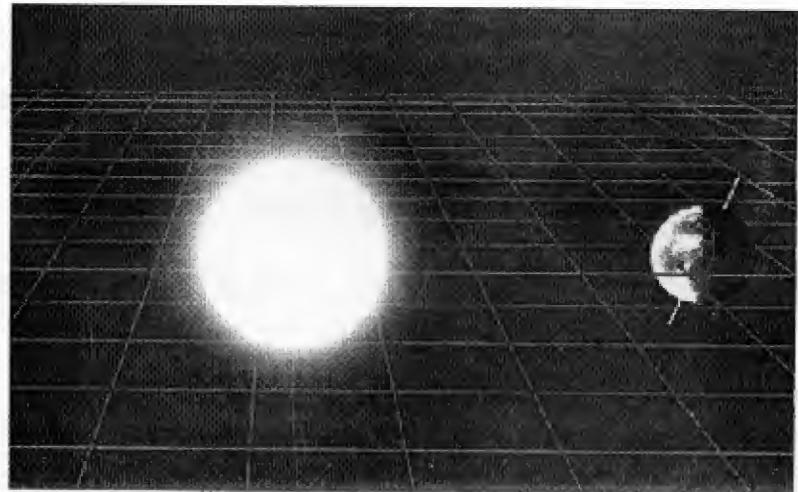
**Question 10** In the above situation which part of the Earth is having summer?

- a. northern hemisphere
- b. southern hemisphere

**Question 11** Which part of the Earth is having winter?

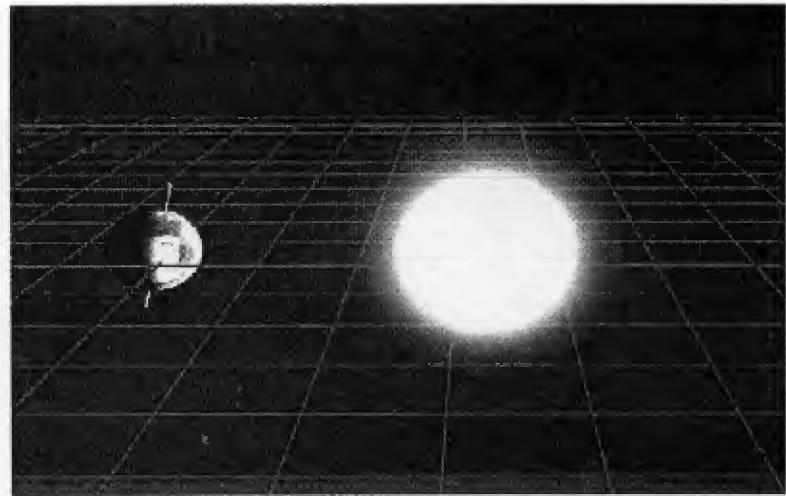
- a. northern hemisphere
- b. southern hemisphere

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Apart from spinning around its own axis, the Earth revolves around the Sun in  $365 \frac{1}{4}$  days.

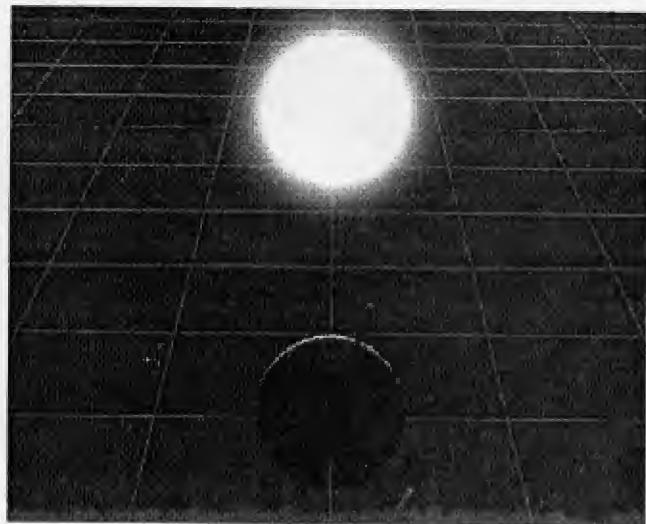
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**Question 12** The above figure corresponds to which month of the year?

- a. November
- b. December
- c. March
- d. June

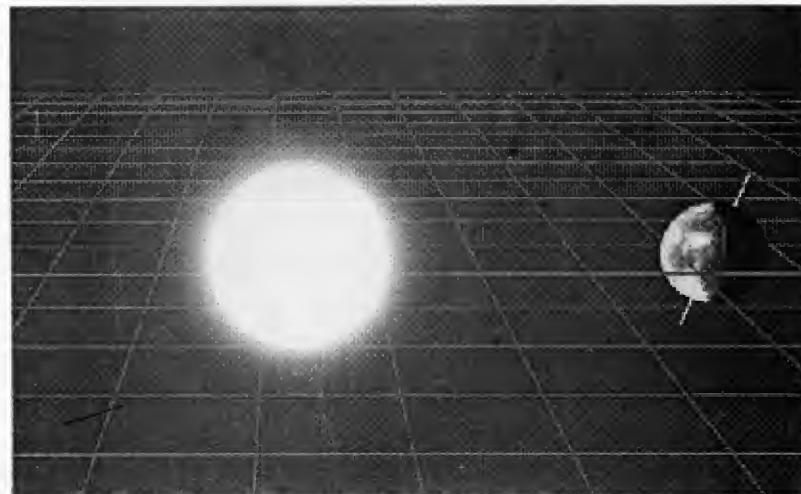
11



**Question 13** The above figure corresponds to which month of the year?

a. March c. September	b. June d. December
--------------------------	------------------------

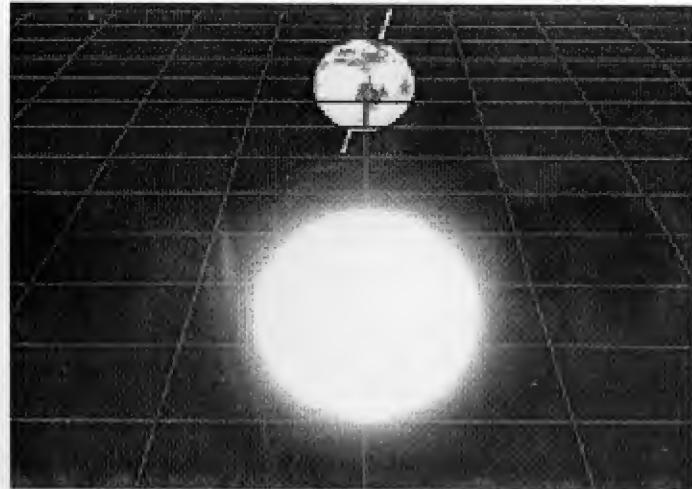
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**Question 14** The above figure corresponds to which month of the year?

a. March c. September	b. June d. December
--------------------------	------------------------

13

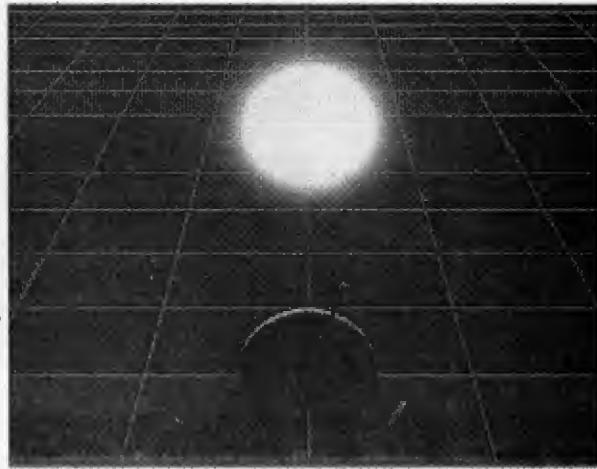


**Question 15** The above figure corresponds to which month of the year?

- a. March
- b. June
- c. September
- d. December

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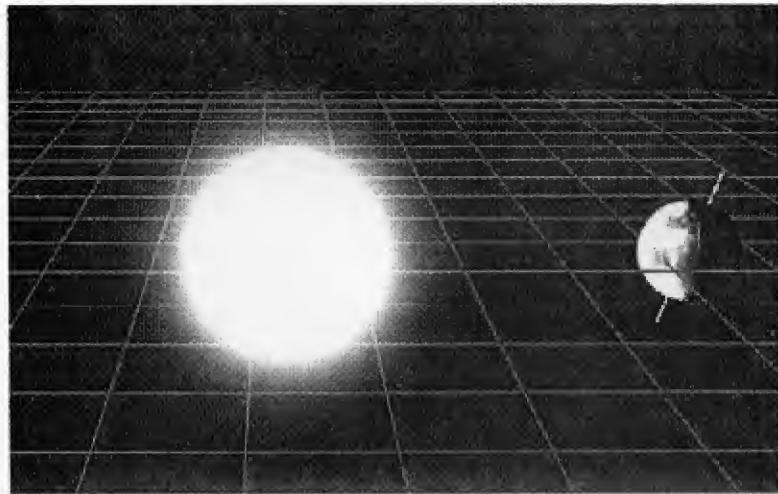
Under this situation the Sun rays are falling equally on both northern and southern hemispheres. That is why both the hemisphere are neither too hot nor too cold.



**Question 16** For the people living on the tropic of Capricorn, the days are of

- a. 12 Hours
- b. More than 12 hours
- c. Less than 12 hours

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In this situation northern hemisphere is cold and southern hemisphere is hot.

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**Question 17** For the people living on the tropic of Cancer, the days are of

a. 12 Hours      b. More than 12 hours      c. Less than 12 hours

**Question 18** At which place the day lasts for 6 months?

a. North Pole	b. Tropic of cancer
c. Equator	d. Tropic of Capricorn

**Question 19** At which place the night lasts for 6 months?

a. North Pole	b. Tropic of cancer
c. Equator	d. Tropic of Capricorn

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# How eclipse occur?

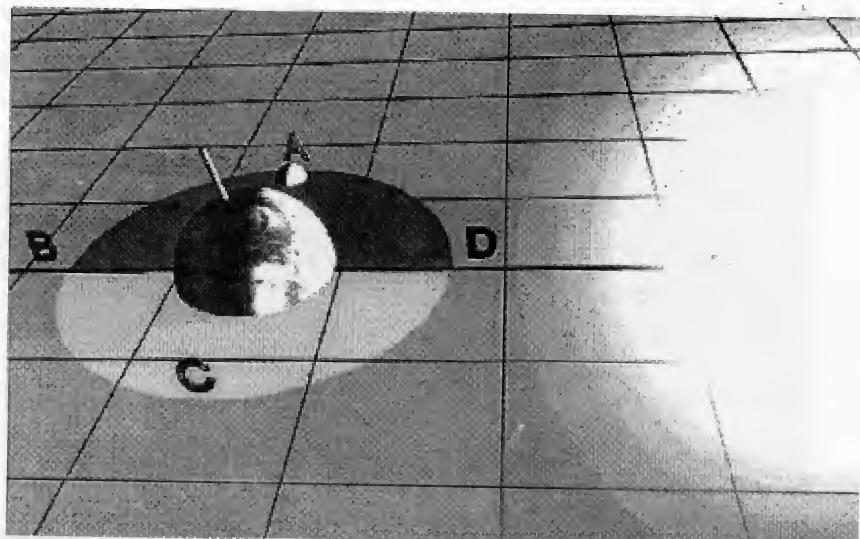
There are many confusions about solar eclipse and lunar eclipse. Let's learn this through science.

We know that the Earth revolves around the Sun. Its axis is inclined at an angle of  $23.5^\circ$ .

To understand the eclipse, it is important to learn about the Moon. The Moon is a satellite of the Earth and it revolves around the Earth. The Moon completes its one revolution around the Earth in 29.5 days.

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The plane of the Earth-Moon is inclined by  $5^\circ$  with relative to the Earth-Sun plane.



**Question 20** In the previous figure, will the shadow of the Moon fall on the Earth?

- a. Yes
- b. NO

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Solar eclipse occurs when the shadow of the Moon falls on the Earth. At this time the Moon, Earth and the Sun come in a straight line. This event typically lasts for 1 minute.



**Question 21** In the previous figure, will the shadow of the Moon fall on the Earth?

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Lunar eclipse occurs when Earth's shadow falls on the Moon. This event typically lasts for about an hour.



**Question 22** On which position the Moon, will Earth's shadow fall on it?

a. A                    b. B                    c. C                    d. D

## Some Information

1. The radius of Earth is 6378 Km.
2. We will have to travel 40091 Km to make one round on the equator. It is 13 times of the distance between Kolkata and Mumbai.
3. The distance between the Earth and the Sun is 15 Crore Km.
4. The Sun light takes 8 minutes to reach the Earth.
5. The radius of Moon is 1738 Km. which is  $\frac{1}{4}$  of Earth's radius.
6. The distance of Moon from the Earth is 384000 Km. which is 60 times the radius of Earth.
7. At the time of solar eclipse the Moon nearly covers the Sun.

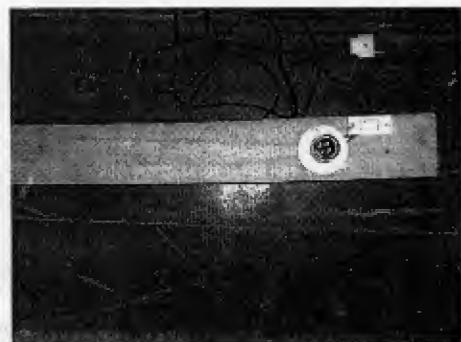
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## Day-Night Model

Required things      Rectangular wood piece, Rubber band, Ball, Motor (8 volt), small wheel, bulb, holder, plug, spoke of Cycle's wheel.

### Method

- (1) Take a 3 feet  $\times$  10 Cm piece of wood.
- (2) Attach a holder with bulb on one side. Connect this holder with wire and plug.
- (3) On the other side, insert the spoke on an acute angle.
- (4) Now, make two holes on the ball. One on top and one on bottom in a line.



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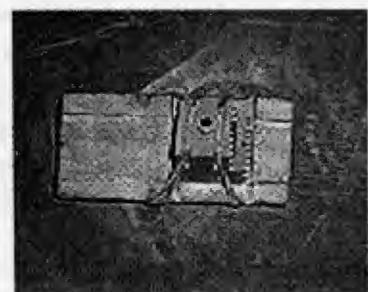
(5) Make three holes around the bottom hole. Fix the wheel in to these holes. The hole of the wheel must be in same position as of the ball.

(6) Now insert the ball in to the spoke. Remember, the face of ball with wheel must be downward. Now test the motion of the ball.

(7) Take a 8 x8 square Cm. piece of wood. Make a small pit in the middle. Now fix the motor in to this pit with the help of rubber bands.

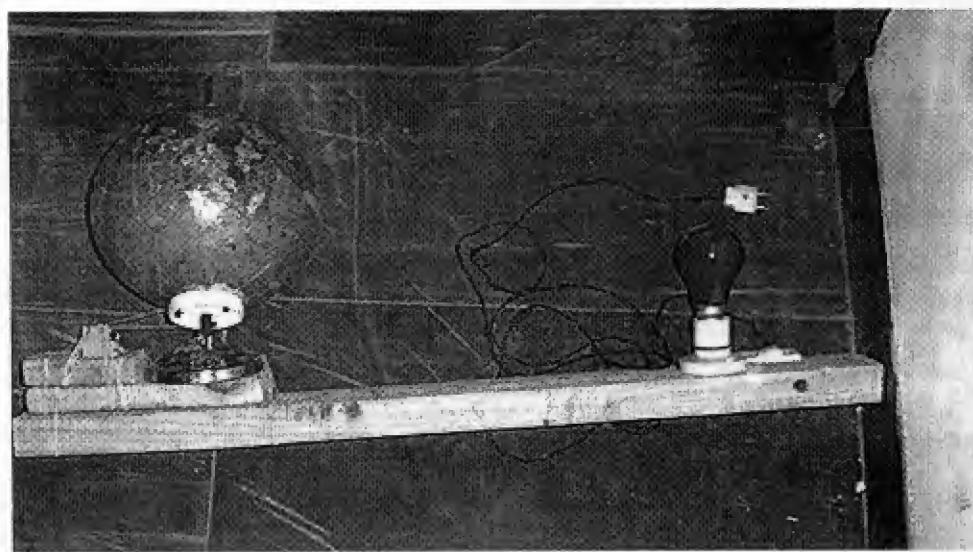
(8) Now fix this wood piece with motor adjacent to the ball on the long wood piece with the help of rubber bands.

(9) Now start and run the motor by the battery. You may need three batteries. Join the batteries in series.



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Now your Day Night model is ready. Switch on the bulb. If you run this model in dark you will see that only the half part is illuminated and other half is dark. Assume the ball as Earth and bulb as Sun.



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## Some More Questions

**Question 23** Day-Night occurs due to

- a. Revolution of Earth around its axis.
- b. Revolution of Earth around the Sun.
- c. Revolution of Sun around the Earth.
- d. None of the above.

**Question 24** Change of season at Earth is due to

- a. Revolution of Earth around its axis.
- b. Revolution of Earth around the Sun.
- c. Revolution of Sun around the Earth.
- d. None of the above.

**Question 25** Latitude of Kanpur is

a.  $20^{\circ}$  N      b  $23\frac{1}{2}^{\circ}$  N      c.  $26\frac{1}{2}^{\circ}$  N      d.  $26\frac{1}{2}^{\circ}$  S

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**Question 26** Longitude of Kanpur is

a.  $0^\circ$       b.  $60^\circ$       c.  $80^\circ$       d.  $100^\circ$

**Question 27** Difference in longitudes for a difference of 1 hour is

a.  $10^\circ$       b.  $15^\circ$       c.  $60^\circ$       d.  $360^\circ$

**Question 28** At noon, the shadow in Kanpur is

a. of zero length.    b. Northward.    c. Southward.    d. Eastward.

**Question 29** During Solar eclipse, what is in the middle?

**Question 30** During Lunar eclipse, what is in the middle?

# **Workshop Report on Day- Night, Seasons and Eclipse**

## **Workshop objective**

Children encounter the concept of Day-Night, Seasons, and Eclipse very early, but cannot quite grasp them because of non-availability of good visual aids. This workshop is designed to explain these concepts using digital tools and reconstructable kits/models.

## **Agency**

Media Lab Asia - Apne Hath Se group.

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## **Venue**

This workshop was carried out at Swami Vivekananda Vidyalaya, Lodhar, run by Jagriti, on Sunday, 2<sup>nd</sup> February 2003, from 11 a.m. to 4 p.m.

## **Participants**

Twenty students from classes VII and VIII attended the workshop. They were divided into groups of 5 members each for the period of the workshop.

## **Facilitators**

A group of 7-10 members, including faculty members of IITK, teachers of the Lodhar School, and students of IITK.

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## **The Workshop Details**

The first half of the workshop involved an animation of “Day-Night, Seasons, and Eclipse”. The various aspects of the above mentioned topics presented to the students included:

- Seasonal changes due to orbital motion of the Earth
- Phases of the Moon
- Solar and lunar eclipse
- Latitudes and longitudes/ time
- A general overview of the Solar system

## **The Workshop**

There were three parts to the workshop

1. Computer animation followed by a discussion
2. Model building
3. Game

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### **Session 1**

This was an interactive session. The groups were shown the animation, and M. K. Verma gave supplementary input about each of the phenomena. Some animations showed the Earth rotating on its axis and the day-night phenomena, the Earth revolving in its orbit and the resulting seasonal changes and so forth. The animation of each phenomenon was followed by a question, students had to choose the correct answer from the set of answers provided before moving on to the next animation. Wherever necessary, the student's doubts were clarified with the help of physical models of the Earth/Sun or solar system and explanations of the phenomena. Students were encouraged to ask questions about the topics covered.



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## **Session 2**

This post-lunch session of the workshop involved active participation of the students in constructing a working model of a part of the solar system- the Earth and the Sun, to demonstrate the night and day phenomenon. First a model was constructed before them and then each group of students was given a set of material to construct a similar model. The facilitators supplemented the efforts of the group if the need was felt for. This entire exercise took about two and a half hours. Each group demonstrated their working model.



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## **Session 3**

This session involves exercise to understand the rotation and revolution of planets in the solar system. Each group of students was to organize themselves as the first 3 planets of the solar system, the Sun and the Moon. The students (planets) moved on marked out circle/ellipses (orbits) so that the proportion of movements of and between the planets was maintained. The concept of the Solar and Lunar eclipse was demonstrated in this exercise.



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These were an experiment on shadow measurement. The student found the direction of the Sun by following shadows observed hourly.



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## Answers

1. a	2. b	3. a	4. c	5. c
6. a	7. c	8. a	9. c	10. b
11. a	12. d	13. c	14. d	15. a
16. a	17. c	18. a	19. a	20. b
21. a	22. d	23. a	24. b	25. c
26. c	27. b	28. b	29. b	30. c

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हमारा गुप्त “आपने हाथ के” एक

ऐसी शिक्षण पद्धति पर कार्य कर रहा है जो शिक्षा को ग्रामीण वातावरण के अनुकूल बना सके। शिक्षा में अत्यधिक प्रतिस्पर्धा एवं व्यवसायिकता के कारण वच्चे शिक्षा में रुचि खो देते हैं।

कुछ मध्यम वर्गीय परिवार के वच्चे तो दबाव के कारण अनिच्छा से कुछ हद तक तथ्य रट लेते हैं परं गरीब विशेषकर ग्रामीण वच्चे पूरी तरह इससे अलग हो जाते हैं। इस परम्परा को खल करने के लिये हम प्रयोगों एवं गतिविधियों पर आधारित शिक्षण पद्धति पर कार्य कर रहे हैं। ऐसा ही एक प्रयास इस पुस्तक में दिखाया गया है।

जागृति वाल विकास समिति

आई.आई.टी. कानपुर